

ART. XII.—*Studies on the Australian Clavariaceae.*

Part II.

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Genus **Clavaria** (*continued*).

In a previous contribution (Proc. Roy. Soc. Vic., n.s. LI. (1), pp. 1-30), the groups 3, 4, 7, 8, and 9 of this genus, as classified by Coker, were dealt with. In this part it is proposed to describe the groups 1, 2, 5, and 10.

GROUP 1 (incomplete).

CLAVARIA AURANTIA Cke et Mass. Grev. XVI., 33, 1887.

(Plate XXII., fig. 3, text fig. 1A.)

Plants simple, solitary, 6-9 cm. high and 2-4 mm. broad. Stem distinct but not sharply delimited, whitish, rather woolly, 1.5-2 cm. long. Club cylindrical, slightly thickened upwards, smooth, except for a few longitudinal rugae, tips bluntly rounded. Colour Orange Chrome. Flesh solid, somewhat fibrous, colour near to Apricot Yellow, pliable, not at all brittle. Taste and smell, none, or very mild.

Spores copious, white, smooth, sub-globose to elliptical. $3.9-6.1 \times 6.2-7.7 \mu$ with one large guttule. Locality: Turton's Pass, Tanybryn; on ground on hillsides.

This species may be distinguished by its deep dark orange colour, solitary habit and elongated, cylindrical clubs. It is recorded from only one locality in Victoria.

Coker has examined a plant of this species (Bresadola Herb. No. 50) and gives a spore measurement which agrees very closely with that of the plant as we know it. He points out the similarity between this plant and *C. aurantio-cinnabarina* Schw. Cooke's illustration of *C. aurantia* suggests our plant in shape and habit, but is rather lighter in colour.

CLAVARIA CAEPICOLOROSA n. sp.

(Plate XIX., figs. 2, 3, 4, text fig. 1R.)

Plantae simplices, gregariae, raro caespitosae, 4-10 cm. alt. (nonnunquam ad 15 cm.), 5-6 mm. latae (nonnunquam 1.5 cm. latae). Stirps cylindrica, octava pars ad quarta pars plantae altitudine cum radicibus non profundis levis aliquantum fulgens multo angustior quam clava, nonnunquam maxime distincta tomentosa ad basem. "English Red" aut minus rubra.

Clava valde cylindrica, aliquantum flexuosa, plerumque levis, sed nonnunquam rugulosa et dilata. Apices obtusae et rotundae nonnunquam dilatae. Colour "Onion Skin Pink" juvenis, postea "Japan Rose," "Congo Pink," "Terra Cotta," "Orange Vinaceous." Caro solida magis colorosum et magis translucens juxta hymenium, in media parte clavae mollis et postea exesa Fragilis facile fracta cum flecta, in aetate cava et saepe exese al- vermiculis. Sporae albae, subglobosae, 7-9 μ latae, leves cum minuto apiculo et una magna gutta.

Hab. ad terram.

Loc. Fairyland, Apollo Bay.

Plant simple, gregarious, rarely caespitose, height 4-10 cm. (sometimes to 15 cm.), 5-6 mm. broad (sometimes to 1.5 cm. broad). Stem cylindrical, $\frac{1}{8}$ - $\frac{1}{4}$ the height of the plant, not deeply rooting, smooth, slightly polished, much narrower than the club, sometimes sharply delimited, hairy at the base, English Red or lighter in colour.

Club stoutly cylindrical, somewhat flexuous, generally smooth but sometimes rugulose and flattened. Tips blunt and round, sometimes flattened. Colour Onion Skin Pink when young, later Japan Rose, Congo Pink, Terra Cotta or Orange Vinaceous. Flesh solid, darker and more translucent just below the hymenium; in the centre of the club, loose, soft and fibrous, tending to tear apart into hollows. Brittle, splintering or snapping with a clean break when bent, hollow in age and frequently attacked by grubs. Spores white, sub-globose, 7-9 μ in diameter, smooth, with a minute apiculus and a single large guttule. Habitat—on ground in gullies, on cliffs and among grass in cleared land. Locality: Fairyland, Apollo Bay.

This is a well-marked species, obviously related to *C. aurantia*. In the field it can be recognized by its colour, stout, more or less cylindrical, clubs and constricted stem.

CLAVARIA ACUTA Fr. ex Sow. Sow, Engl. Fungi, pl. 333, 1803.

?*C. falcata* Pers. Comm. p. 81 (213), 1797.

(Text fig. 1 (v).)

Plants simple, single or in small caespitose clumps, between 2 and 5 cm. high. Stem equal to about one-third the plant or less, translucent, shining, glistening with minute, scurfy projections. Club thickened upwards, often expanded at the tip and bluntly bilobed, sometimes cylindrical, but more often flattened. Flesh solid, translucent, soft and very fragile, breaking cleanly when even slightly bent. Taste and odour none. Colour, pure milky white.

Spores white, smooth, sub-spherical but with one side definitely flattened and with a distinct apical mucro, 7-8.5 \times 8-10 μ . Growing on bare ground in gullies or among moss in heathland.

Localities: Otway Forest, Cockatoo, Mt. Evelyn, Phillip Island. Not previously recorded for Australia.

This species can be readily recognized by the pure white colour, translucent, shining stem, extreme fragility and by the sub-spherical spores which show one flattened side. It is obviously closely related to *C. rosea* (sensu Cotton and Wakefield) and to *C. luteostirpata*.

CLAVARIA LUTEOSTIRPATA n. sp.

(Plate XIX., fig. 5, text fig. 1 (o).)

Plantae simplices, singulae, aut caespitosae in parvis fascibus, gregariae, 3-7 cm. altae, stirps aequalis ad tertiam partem planti, distincta sed in hymenium mergens, teretis, levis et fulgens. "Empire Yellow" cum radicibus non profundis. Subiculum non obvium. Clava 2-5 cm. longa, 2-5 mm. lata si cylindrica, 3-4 mm. si dilata, recta aut magis sinuosa, saepius cum apice latiore, nonnunquam compressa et raro cum uno aut duobus cornibus in apice. Apices obtusae, leniter spiculatae. Colour "Pinard Yellow," magis translucens cum juvenis. Caro clavae similis coloris quam exterior pars, mollis, fragilis, stirps cum cortice cartilaginosa sed mollior ad interiorem partem.

Sapor et odor nullus aut blandissimus.

Sporae albae, leves, sub-globosae, cum apiculo prominenti, 6.2-9 × 7.3-10 μ av. 7.5-8.8 μ, cum magna gutta.

Hab. ad terram. Loc. Cockatoo.

Plants simple, solitary or caespitose in small groups, gregarious, height 3-7 cm., the stem equal to one-third of the plant, distinct, but grading into the hymenium, terete, smooth and shining. Empire Yellow, not deeply rooting, subiculum not obvious, club 2-5 cm. long, 2.5 mm. wide if cylindrical, 3-4 mm. if flattened, straight or rather flexuous, usually broader at the apex, sometimes compressed and rarely with one or two antler-like branches at the apex. Tips bluntly pointed, gently tapered. Colour Pinard Yellow, rather translucent when young. Flesh of club, concolorous, soft, brittle, stem with a cartilaginous rind but softer in the centre. Taste and odour none or very mild.

Spores white, smooth, sub-globose, with a prominent apiculus, 6.2-9 × 7.3-10.4 μ, average 7.5-8.8 μ, with a large guttule. Habitat—on ground in gullies. Localities: Cockatoo, Otway Forest.

This is a very well-marked species and can be readily distinguished by the shining yellow stem and paler, rather translucent club. It is near to *C. appalachiensis* Coker but differs in its smooth hymenium and larger spores. It is obviously related to *C. rosea* (sensu Cotton and Wakefield) as the spores are very similar and this plant has also a shining stem and paler club. The two species are very often found growing together.

GROUP 2.

CLAVARIA FUSIFORMIS Fr. ex Sow. Sow. Engl. Fung., pl. 234.
1799.

- C. fasciculata* Villars. Hist. Plant. Dauph., 3: 1052, 1789.
C. platyclada Pk. Bull. Torrey Bot. Club, 23: 419, 1896.
C. compressa Schw. Trans. Am. Phil. Soc. II., 4: 182, 1832.
 (Not *C. compressa* Berk. or *C. compressa* Schroet.)
C. ceranoides Pers. Syn. Met. Fung., p. 594, 1801.

(Plate XVII., figs. 4 and 5, text fig. 1 (L).)

Plants simple, usually growing in dense clusters, 4–6 cm. high, and 2–4 mm. wide, solid, sometimes cylindrical but more often flattened, at times thickened upwards, and spatulate at the tips, again thickened to about the middle and tapering to a blunt point at the apex. Base not distinct. Flesh firm, paler than the surface, opaque, solid, (not often with a hollow in the centre as in American and European plants). Moderately brittle, not snapping with a clean break when bent. Colour Light Cadmium or Empire Yellow, Capueine Buff in age. Taste varies from mild to bitter, smell none. Spores 5–7 μ diameter, globose, smooth with a very distinct abrupt apiculus, with or without a large central gutta. Spore deposit yellow or white (this character has been observed in American plants, but the spores show no differences microscopically). Habitat—on ground in open or sheltered places, sometimes on buried sticks. Widespread in Victoria. Not previously recorded for this State. There is a multiplicity of species of simple yellow *Clavarias* in Victoria, some of which are difficult to determine accurately, but among them *C. fusiformis* can be readily identified by the following characters:—

1. Fascicled habit.
2. Bright, opaque, egg-yellow clubs.
3. Blunt tips and generally flattened clubs.

CLAVARIA VERMICULARIS Fr. ex Micheli. Fr. Syst. Myc. 1, 484.
1821.

Micheli Nova Plant Gen., p. 209, pl. 87, fig. 12, 1729.
(as *C. vermiculata*).

- C. cylindrica* Bull. Herb. Fr., p. 212, pl. 463, fig. 1, 1789.
C. fragilis Holmsk. Beata Ruris, 1: 7, pls. 2 and 3, 1790.
C. gracilis Sow. Engl. Fung., pl. 232, 1797.
C. eburnea Pers. Syn. Met. Fung., p. 603, 1801.
 ?*C. canaliculata* Fr. Obs. Myc. 2: 294, 1818.
 (not *C. canaliculata* Ehrenb.).
C. alba Pers. Myc. Europ., 1, 175, 1822.
 (not *C. alba* Pers. *ibid.*, p. 161).
C. pistilliforma Pers. Myc. Europ., 1: 183, 1822.
 ?*C. corynoides* Pk. Rept. N.Y. St. Mus., 31: 39, 1879.
C. nivea Quel. Assoc. Francaise, p. 3, pl. 3, fig. 11, 1901.
 (22nd supplement to Champ. Jura, etc.).

(Text fig. 1 (E).)

Plants most often gregarious, sometimes single. Simple or very sparingly branched, up to 4 cm. high and 2-3 mm. broad. Stem not distinct, clubs pure white, thickened upwards, bluntly pointed. Flesh, white, rather translucent, very brittle. Taste and smell, none. On drying the plants become Isabella Colour and on being placed in water regain their former shape instantly.

Spores, globose, smooth, hyaline, minutely apiculate, $3-5 \times 3-4 \mu$. Basidia with four sterigmata. Habitat—on ground in gullies. Locality: Dandenong Ranges.

Cooke records this plant for Victoria but gives the spore measurement as $8 \times 6 \mu$. If these spore measurements are correct it is possible that he had either *C. cristata* (*rugosa* form) or *C. acuta*. Coker calls this plant *C. vermiculata* Micheli but according to the Rules of Botanical Nomenclature, the Friesian name *C. vermicularis* is valid.

This species can be distinguished from *C. acuta* by its more slender habit, indistinct stem, smaller spores and by the fact that it tends to grow in groups. Dried plants of *C. acuta* do not instantly regain their shape on moistening.

CLAVARIA CORALLINO-ROSACEA Clel. Aust. Fungi: Notes and Descriptions, No. 8. Trans. S.A. Roy. Soc., Vol. LV., 1931, pp. 152-160, 1931.

(Plate XXII., figs. 5 and 6, text fig. 1 (B).)

Plants simple, occasionally antlered, growing in large colonies, but the bases usually separate. Height up to 12 cm., commonly 6-9 cm., breadth up to 5 mm., commonly 2-4 mm.

Stem not distinct, rather smoother than the club, slightly polished. Clubs broadest in the middle, attenuated above and below, tapering to a blunt point at the apex, generally flattened and ribbon-like, flexuous, quite frequently cylindrical and straight. When young, smooth, later developing longitudinal wrinkles. Flesh solid, concolorous beneath the hymenium, paler in the centre of the club. Taste slight, pleasant and sweet, similar to that of *C. pulchra*; smell similar, persisting in dried plants. Colour, Coral Pink, Light Coral Red, Coral Red, fading in age, and paler and more yellowish in underground parts.

Spores, white in thin layer, same colour as the club when scraped together, $7-10 \times 3-4.4 \mu$. Once or twice guttulate, smooth, obliquely pip-shaped, pointed at both ends when mature, rounded at the distal end in youth. Basidia with 2 or 4 sterigmata. Hyphae $4-5 \mu$ wide, containing many oil droplets. Habitat—on ground, very widespread in Victoria.

Cleland first recorded this plant as *C. rosea* but later described it as a new species. The plants he described are generally smaller and have shorter spores than the Victorian plants. In addition, he describes the spores as "somewhat pear-shaped, $6 \times 3.4-4 \mu$ ". Cleland examined a collection of the Victorian plant and says that it is undoubtedly *C. corallino-rosacca*.

He records the plant for New South Wales and South Australia but, although widespread in this State, it has not been previously recorded here. A plant, No. 249, in the Rodway Herbarium is probably this species. It shows no spores.

CLAVARIA PULCHRA Pk. Rept. N.Y. St. Mus. 28: 53, pl. 1, fig. 10, 1876.

C. angustata Pers. (Sense of Schw.) Comm., p. 72, 1797.

C. persimilis Cotton, Trans. Brit. Myc. Soc. 3: 182, 1909.

(Plate XIX., fig. 1, text fig. 1 (g).)

Plants gregarious, caespitose in small clusters, or occasionally single. Up to 12 cm. high, 1 cm. broad and 4 mm. thick. Sometimes cylindrical with a bluntly pointed tip, more often flattened and channelled, usually flexuous; rudimentary branches often present. Clubs thickened upwards, stem smooth, glabrous, narrower than the club, but not sharply delimited. Hymenium smooth or with a few longitudinal wrinkles. Flesh soft, whitish in the centre, rather fibrous, pliable, not brittle, but breaking when bent upon itself. Taste and odour, sweet, like that of *C. corallino-rosacea*. Colour, Cadmium Yellow, Flame Scarlet to Orange Chrome, Capucine Yellow to Deep Chrome, Light Cadmium to Pinard Yellow. Base whitish for a variable distance upwards. Spores, oblong-elliptical, with a prominent oblique mucro, white, $4.2-5.3 \times 6.7-7.8 \mu$. Habitat—on ground in forest country. Widespread in Victoria. Not previously recorded for Australia.

This plant shows most of the characters of *C. pulchra* as understood by Coker but the spores, although similar in shape, are narrower than and show a greater range in length than the American plants.

C. pulchra can be distinguished from *C. fusiformis* by (1) oblong spores, (2) deeper orange colour, (3) rather more irregular clubs, (4) lack of strongly fasciated habit.

GROUP 5.

CLAVARIA MIYABEANA S. Ito. Trans. Sapp. Nat. Hist. Soc., Vol. XI., Pt. 2, p. 72, 1930.

(Plate XXIII., text fig. 1 (J).)

Plants commonly densely caespitose, sometimes in loose clusters, rarely single, 3-14 cm. high, 0.5-7 cm. broad. The smaller plants are generally simple and club-like, at first almost cylindrical, later flattened, thickened upwards, and with a distinct broad groove on either side, edges rounded, apex broadly obtuse or showing one or two rudimentary antler-like branches. Larger plants assume very varied and fantastic shapes, very much flattened and expanded laterally with a sinuous, often inrolled

margin and with many fine longitudinal striations; or knobbed and irregular at the apex, tapering to a slender base; or forming a dense convoluted, compact mass. Base not sharply delimited, often deeply rooting, sometimes attached to buried sticks, concolorous or whitish. Flesh, solid, rather loose in irregular specimens, paler than the surface. Taste and smell, slight and pleasant. Colour: Grenadine and Grenadine Red.

Basidia with two or four sterigmata, spores white in mass, globose, smooth, with a well-marked apiculus and a large central gutta, $6.3-8.2 \times 6.5-8.5 \mu$. Habitat—on sandy soil under bracken and on peaty soils in swampy areas. Localities: Hordern Vale, Hedley.

Not previously recorded for Australia. This is easily the most spectacular species of *Clavaria* that occurs in Victoria and can be easily recognized by its brilliant, orange-red colour, by its large size and generally contorted clubs. It agrees very closely with the description of the type. It is known to a number of people at Hedley as the "Flame Fungus" and it appears worth while to retain this as the vernacular name for the species as it is so descriptive. This species, particularly in those specimens which are very much flattened and expanded, apparently shows affinities with *Craterellus* as do *Clavaria pistillaris* and *Clavaria ligula*.

CLAVARIA PALLIDOROSEA n. sp.

(Plate XX., fig. 2, text fig. 1 (Q).)

Plantae singulae aut gregariae in parvis fasciculis, 6-11 cm. alt., .5-1 cm. lat. Basis rotunda, saepe cava, brevis, cum radicibus non ex profundo surgentibus, junctio cum hymenio inaequalissima. Clava saepissime latescens et torquens, cum multis rugis in longitudinem, nonnullae latis. Apices obtusae, rotundae, aut latescentes et se dividentes in duos ramos corvutos. Colour "Bittersweet Pink" cum nota crocea in apice. In aetate aut sicca magis lutea. Caro solida "Grenadine Pink", opaca, fragilis facile fracta flectendo, nonnumquam cava ad basem. Sapor et odor dulcis, similis ad C. corallino-rosacea. Interior pars habet tenues hyphas inter se innectentes. Basidia clavata, cum duobus aut quattuor sterigmatibus. Sporae leves, in massa albae, globosae cum apiculo recto et prominenti $4.8-6.9 \times 5.1-6.9 \mu$ (av. $5.4 \times 5.9 \mu$), una magna gutta. Hab. ad terram carbonaceam. Loc. Labor-touche.

Plants single or gregarious in small clusters, 6-11 cm. high, 0.5-1 cm. broad. Base rounded, often hollow, short, not deeply rooting. Junction with hymenium very irregular. Club typically flattened and twisted, finely rugose, with a few broad longitudinal wrinkles. Tips obtuse and rounded or flattened and divided into two antlered branches. Colour: Bittersweet Pink, with a hint of orange at the tip, creamy yellow in age or on drying. Taste and smell, sweet and pleasant, rather like *C. corallino-rosacea*.

Flesh solid, Grenadine Pink, opaque, brittle, snapping when bent, sometimes becoming hollow towards the base. Internal structure of fine, slightly interwoven hyphae. Basidia clavate, with two or four sterigmata. Spores smooth, white in mass, globose, with a prominent, straight apiculus, $4.8-6.9 \times 5.1-6.9 \mu$ (av. $5.4 \times 5.9 \mu$) with one large central gutta. Habitat—on burnt ground. Locality: Labertouche.

The colour and habit of this plant suggests *C. pistillaris*, but the spores of the latter are much larger ($9-18 \mu$ long). It can be readily distinguished in the field by its stout habit, orange-pink colour, and globose spores. It is obviously related to *C. Miyabeana*, but differs in colour, is more regular in habit, and has smaller spores.

GROUP 10 (incomplete).

CLAVARIA SINAPICOLOR Clal. Aust. Fungi Notes and Descriptions No. 8. Trans. Roy. Soc. S.A., Vol. LV., 1931, pp. 152-160.

(Plate XXI., figs. 1-7, 9, text fig. 1 (c).)

Plants massive and branched, up to 12 cm. high and 9 cm. broad, growing singly, or small and slender, occasionally growing singly but generally in extensive clumps, either free or partially fused at the base. It is obvious that large single plants have arisen through the fusion of several or many individuals, as in almost any large colony of this plant a series of plants showing progressive stages of complexity due to the fusion of separate individuals can be found.

Base of simple plants, cylindrical, somewhat pointed below, branching dichotomously near the ground into two branches which are not markedly different from the stem in size. These primary branches usually elongate a great deal before branching in a similar fashion, and after this may branch once or twice to form the ultimate tips which are long, upright or flexuous, and cylindrical, tapering to blunt tips. Axils rounded, but trend of the branches upright, a furrow descending from either side of each axil, branches cylindrical but somewhat flattened at each axil.

The branching of the complex plants is similar to that of the simple ones. The trunk may be slender, vertical rugae indicating that the plant is the result of the fusion of several; or if stout, composed of many fine compacted stems. Colour, Naples Yellow, Mustard Yellow, Straw Yellow, Light Orange Yellow. Flesh white, or pale creamy yellow, solid. Taste mild, smell sweet, rather like that of broome or gorse, strong in age. Spores ochraceous, elliptical, moderately rough, with an oblique apiculus $3-4.5 \times 6-8-10 \mu$. There is some indication that on the whole large plants produce longer spores than small plants.

This is a very abundant species in Victoria and has been collected between March and November. It can be distinguished by the generally tufted habit, yellow colour and upright, cylindrical branches with somewhat flattened axils.

CLAVARIA FENNICA Karst. Nat. Sällsk. Faun. et Flora Fenn. 9, 372, 1868 (not *C. fennica* Karst. Bidr. Finl. Nat. Folk. 48: 47, 1889. = *C. decolorans* Karst. Symbolae ad Myc. Fenn. 32: 10, 1893.).

?*C. rufo-violacea* Barla Champ. Nice, p. 87, pl. 41, figs. 3-13, 1859.

C. fumigata Pk. Rept. N.Y. St. Mus. 31, 38, 1879.

Ramaria versatilis Quel. in Assoc. Fr. Av. Sci. Compte Rendu 22, Pt. 2, 489 (1893), 1894.

C. versatilis Quel. (Boud. and Galzin) Bull. Soc. Myc. Fr. 26: 214, 1910.

Clavariella versatilis (Quel.) Maire Bull. Soc. Myc. Fr. 30: 218, pl. 9, figs. 1, 1b, 1s, 1914.

(Plate XVIII., fig. 2, text fig. 1 (M).)

Plant branched and bulky up to $5 \times 5 \times 10$ cm. Base typically stout and distinct, more or less cylindrical, often bulbous, attached to the soil by a few inconspicuous fibres. Branches arising as in *C. botrytis*, i.e., beginning as knob-like projections on the upper part of the trunk, and elongating until maturity. Branching irregular or sub-dichotomous, the ultimate tips being produced after three or four divisions. These tips are generally truncate and cylindrical, bearing a few small cusps, or rarely toothed and flattened, giving a palmate appearance, and are so densely crowded as to obscure the main branches. Large primary branches, if present, are rugose and up to 6 mm. wide, secondary branches 4 mm., tertiary branches and tips about 1.5 mm. wide.

Flesh, soft, white or creamy, opaque, composed of interwoven hyphae. Taste, indistinct and mild. Colour, whitish at base of stem, Deep Dull Lavender in upper parts. In age, the entire plant becomes Vinaceous Drab with the purple colour disappearing (except at the top of the stem) until finally the plant is a smoky greyish green with only a suggestion of purple at the tips, on the main branches, and top of the stem.

Spores, ochraceous in mass, microscopically slightly coloured, elliptical with an obliquely terminal micro, evenly and finely warty, $4.5-5.8 \times 10.3-11.1 \mu$. Basidia with four straight sterigmata. Habitat—on ground. Localities: Macedon, Eganstown, Mt. Wilson.

The spores of this plant are slightly longer and wider than those of the European specimens, which have spores $3.7-4.4 \times 9.8-11 \mu$, but in other features the plants are similar. *C. fennica* as understood by Bresadola has a purple stem and greenish-yellow branches but it is otherwise similar to the Victorian plant. It is possible that the plants illustrated by Bresadola are over-mature specimens. *C. fennica* has not been previously recorded for Australia but a purple Clavaria, painted by the late Mrs. Ellis Rowan, is probably *C. fennica*. Cleland suggested that the painting might be of *C. vinacco-cervina* but this species never shows the bright, rich purple or the rather regular branches of the plant illustrated.

C. fennica differs from *C. Nymaniana* in having a thick, glabrous base, deeper colour and roughened, elongated, ochraceous spores. Illustration: Painting by Mrs. Ellis Rowan, Victorian Field Naturalist, Vol. XLIX., No. 2, pl. ii.

CLAVARIA RUFESCENS Fr. ex Schaeff. Schaeff. Fung. Bavar. pl. 288, 1770.

C. holorubella Atk. Ann. Myc. 6: 57, 1908.

C. australiana Clel. Aust. Fung. Notes and Desc. No. 8 Trans. S.A. Roy. Soc., vol. LV. 152-160, 1931.

(Plate XX., fig. 1, pl. XXII., fig. 1, text fig. 1 (F), (K).)

Plants large, 10-12 (sometimes up to 20) cm. high, to 7 (sometimes 10-15) cm. wide. Stem rooting, distinct, stout, smooth, whitish, occasionally with picric yellow stains. A few large branches or many smaller ones arise directly from the trunk, these branching one to four times to form a mass of fine, cylindrical, rather abruptly truncate tips, which bear a few blunt cusps and form a rather loose mass. Axils slightly rounded, branches rugose or occasionally quite smooth. Colour, when young the body of the plant is Cinnamon Buff with the tips Vinaceous. At maturity the purplish colour becomes more pronounced and extensive, and the upper parts of the branches vary between Hydrangea Red and Dark Vinaceous. In age, the entire plant, with the exception of the base, takes on a brownish colour and the purplish colour of the tips is somewhat masked.

Taste, not distinct, mild. Flesh, white and soft, brittle in young plants, soft and somewhat pliable at maturity. Spores, elliptical, with an obliquely terminal mucro, roughened, longitudinally or obliquely striate, ochraceous in the mass. $3-4.5 \times 12-15.5 \mu$. Localities: Cockatoo, Eganstown, Toolangi, Erica, Kallista, Kinglake.

This plant is moderately common in Victoria and can be easily recognized by its vinaceous tips and buffy-brown body. It has been very much confused with *C. botrytis* (for discussion of the differences between the species see under *C. botrytis*). Cleland's description of *C. australiana* only differs from that of *C. rufescens* in the character of the spores, which are described as "microscopically slightly coloured, elongated, oblique, mummy-shaped, not striate, $11-13-16 \times 4.5-5.5 \mu$, rarely $8.5 \times 4 \mu$ ". I have examined a specimen of *C. australiana* from Cleland's Herbarium and find that the spores are definitely obliquely striate, $10-13 \times 4.5-5.5 \mu$. Thus the plant could be placed as *C. holorubella* Atk., but Coker, on good evidence, regards this as synonymous with *C. rufescens*.

CLAVARIA BOTRYTIS Fr. ex Pers. Pers. Comm., p. 41 (174), 1799.
Fr. Hym. Eur. 667.

?*C. acroporphyrca* Schaeff. Fung. Bavar., pl. 176, 1763.

?*C. plebeja* Wulfen in Jacq. Misc. 2: 101, pl. 13, 1781.

C. purpurascens Paulet in Paulet et Lev. Icon. Champ., p. 113, pl. 194, fig. 6, 1855.

C. botrytoides Pk. Bull. N.Y. St. Mus. 94: 21 and 49, pl. 93, figs. 5-7, 1905.

C. conjuncta Pk. Bull. N.Y. St. Mus. 105: 16 and 42, pl. 102, 1906.

(Plate XVIII., figs. 1, 3, pl. XXII., fig. 4, text fig. 1 (P).)

Plants large, branched, up to 16 cm. wide and 12 cm. high, usually medium-sized, up to 8 cm. high, rarely small, 3-5 cm. high. Base solid, tapering, stout, not deeply rooting. Occasionally several plants arise together (pl. xviii., fig. 1), in which case the bases are distinct and relatively slender. Branching irregularly dichotomous, many branches arising directly from the top and sides of the trunk, branches knoblike in youth, at maturity elongated, more or less cylindrical in the upper parts, axils eventually somewhat rounded, with a furrow descending on either side. Tips of branches with a number of obtuse, short tips. At maturity the plant presents a compact cauliflower-like appearance but as the branches continue to elongate, in age the plant is straggling and loose.

Flesh, until maturity, white, solid, crisp, and brittle; in age, soft and lax, somewhat pliable, Pale Buff in colour. Colour of mature plant: base whitish, body of plant, Salmon Buff, tips Grenadine; in youth, the entire plant, with the exception of the white base, is Grenadine, and at maturity this colour is retained by many undeveloped twiglets at the base. In age, the entire plant fades to Salmon Buff or darker but vestiges of the bright pink colour are often apparent at the tips, even in decaying plants.

Spores, Light Buff Yellow, minutely rough to almost smooth, $3.8-4.2 \times 7.5-10 \mu$ elliptical, with an oblique, terminal apiculus.

This is an exceedingly common species in Victoria and may be readily identified by the bright pink tips, paler body, and the brightly coloured, undeveloped branches at the base. A pallid, whitish plant, resembling *C. botrytis* in every character except colour, has been collected at Warrandyte on several occasions. In all cases, it has been found growing closely associated with characteristic plants of *C. botrytis* and may be regarded as an abnormal form of it. Cooke records *C. botrytis* (calling it *C. botrytes* in error) for Victoria, Queensland, New South Wales, Western Australia and Tasmania. He places it in the group *Leucosporae* of the sub-genus *Ramaria* but this is incorrect as the spores are coloured. He, also, in common with Cotton and Wakefield and others, has apparently confused *C. botrytis* with *C. rufescens* as he gives the spore measurement as $12-15 \times 6 \mu$. *C. botrytis* and *C. rufescens* can be easily distinguished

as the tips of the former are bright, clear pink becoming paler with age, and are typically thick, while those of *C. rufescens* are usually fine, and are somewhat dusky and Vinaceous Pink in youth, darkening with age. In addition, the spores of *C. rufescens* are obliquely striate and longer than those of *C. botrytis* which are almost evenly roughened. *C. rufescens* has a smooth, tapering base which never shows brightly coloured undeveloped branches.

C. botrytis is edible and quite pleasant to taste. It is apparently eaten by rabbits and possibly other animals; plants gnawed off to ground level and bearing marks of teeth are frequently found. Localities: Common in hilly country south of the Dividing Range. March to November.

CLAVARIA CAPITATA Lloyd. Myc. Notes, Vol. 7, p. 1107, 1922.

(Plate XVII, figs. 1, 2, 3, 6, pl. XX., fig. 3, text fig. 1 (N).)

Plants branched and bulky, several arising together from a mycelial mass, which binds the soil together. Trunk of plant not obvious as the plants branch close to the base, furrowed, apparently as a result of the fusion of separate stems, white, and frequently with numerous pale, undeveloped branches (or separate young plants) at the base. Primary branches up to 1.5 cm. in diameter, usually about 0.8 cm.; secondary branches arising in a group from the primary branches, upright and rather crowded, axils very acute, but the branches often bend sharply outwards before continuing their upward growth. The secondary branches may give rise to another series in a similar manner or may produce the ultimate tips. These at first consist of a number of sub-globose, non-viscid swellings at the end of each branch and soon after their formation, differ sharply in colour and texture from the body of the plant. Towards maturity, these tips expand laterally and often coalesce; thus the upper surface of the plant may become more or less continuous and is usually finely convoluted. When the tips are not at approximately the same level, smaller areas become continuous and the plant presents a terraced appearance. The increase in size of the tips tends to strain the lower parts of the plant and splitting frequently occurs at the axils. At maturity, the tips are extremely sticky to the touch but the rest of the plant is dry. Colour, body of plant Maize Yellow to Pale Orange Yellow. Tips paler than Honey Yellow but yellower than Chamois, semitranslucent. Flesh white, crisp and brittle, taste mild.

Spores $11-13 \times 4.2-5 \mu$. Elliptical, with a prominent oblique apiculus, definitely rough, ochraceous in mass, microscopically hyaline. Basidia most frequently with two, sometimes with four, sterigmata, hymenium covering the branches as well as the tips, clamp connections not seen.

The hyphae composing the body of the plant are only slightly interwoven and rather broad. In the young state the hyphae composing the tips are closely compacted and as the plant matures they proliferate and become much finer, intertwining freely. It is at this stage that fusion between closely approximated tips occurs and this accounts for the fact that small, closed pockets, lined with fertile hymenium, may often be observed in prepared sections of the tip region. The growth at the tips is not so much in a vertical direction as lateral, and results in the curling back of free edges of the tips. Finally, these tips develop normal basidia but this occurs later than on the branches (this may account for Lloyd's statement that the branches are sterile). The stickiness of the tips may be due to the exosmosis of sugary substances as sections of mature tips show no breakdown of the hyphae composing them. It has been observed that the hyphae of the tips, both before and after the production of basidia and spores, are much more densely protoplasmic than those immediately beneath the hymenium on the branches, and than those composing the main substances of the plant.

This plant, as far as is known, is peculiar to Australia. It was first collected by Mr. E. J. Semmens, of the Creswick Forestry School, and was sent to Lloyd, who published the following description.

"*Clavaria capitata*—stems slightly sulcate, few branched. Branches terminating in sub-globose heads bearing the hymenium, spores 7–13–16 μ , if coloured, very pale, smooth, laterally apiculate at the base. Evidently grows on the ground. Colour, which Mr. Semmens says has not changed much, is the Isabelline colour that most white plants take on in drying, nothing distinctive. The idea of a *Clavaria* not having the hymenium over stems or branches, but confined to terminal heads, is a new one, I think, in *Clavarias*, hence could be made a new genus (*Capitoclavaria capitata*)."

Although Lloyd does not make it clear that he was describing a new species, no trace of an earlier description of a plant bearing this name can be found. In a letter, Mr. Semmens says that Mr. Lloyd did not mention at the time that it was a new species, but he, himself, had always understood it to be so. The identification of *Clavaria capitata* from Lloyd's description would be a difficult matter, but Mr. Semmens has given us a co-type specimen and this is identical with the plants I have described above. As the co-type (and further collections of the plant) show differences from Lloyd's description, the following amended description is put forward.

CLAVARIA CAPITATA Lloyd em. Fawcett.

Plantae ramosae et satis magnae, gregariae, emergentes in fascibus e massa mycelii humum colligantis. Trunca non manifesta, juxta terram se dividens, axiles acuti. Cacumina

primum sub-globosa, non-viscida, diende se dilatantia, interdum conjungentia in massam densam, nunc viscida et maxime differentia textura et colore ab ramis qui leves et non-viscidi sunt. Color cacuminum inter "Honey Yellow" et "Chamois," reliquarum partium praeter basis qui albus est "Maize Yellow" ad "Pale Orange Yellow." Caro alba, crispus et fragilis, sapor blandus.

Hymenium et ramos et cacumina tegit; postea in cacuminibus oritur. Basidia plurimum bispora, interdum quadrispora. Sporae 11-13 × 4.2-5 μ, ellipsoideae cum apiculo obliquo prominenti, omnino asperae, ochraceae. Loc. Ararat (type). Kinglake, Tourrorrong, Healesville, Cockatoo.

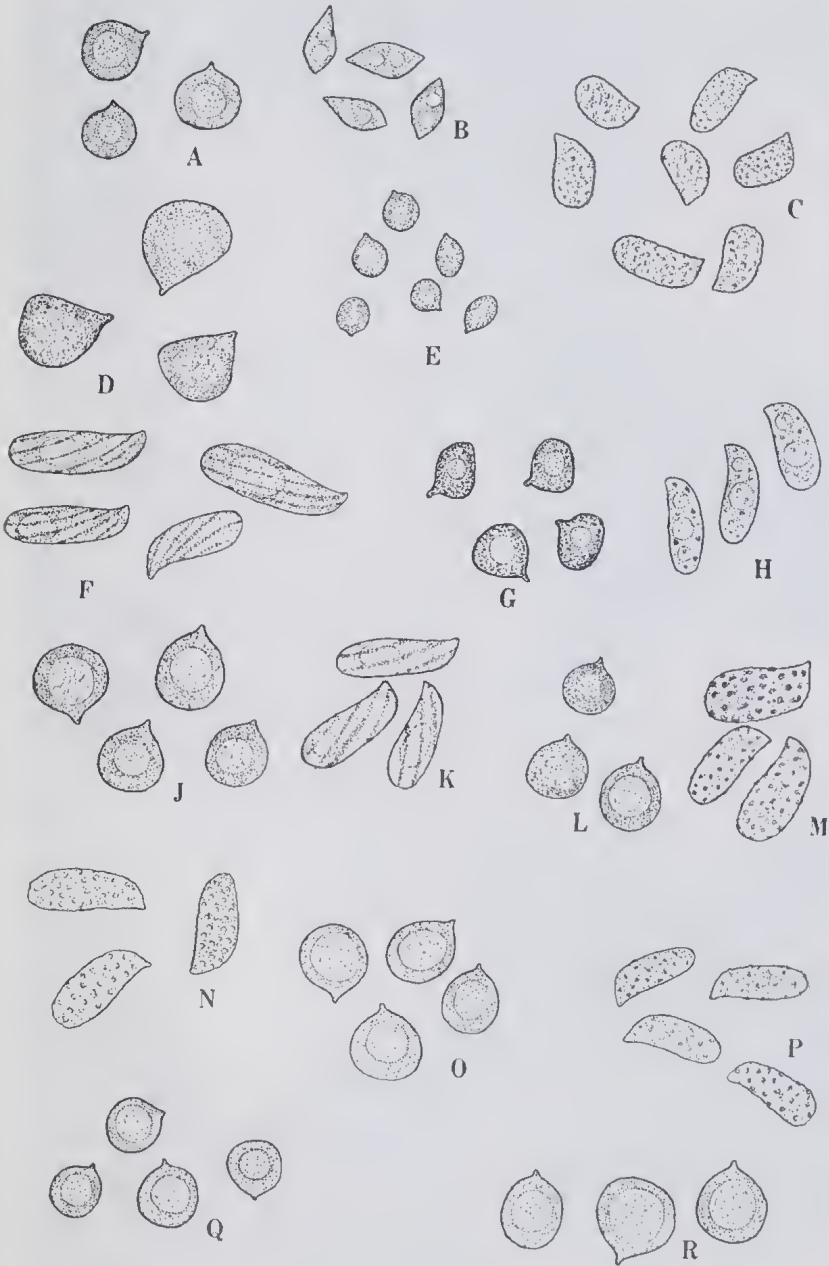
Clavaria capitata is a very well marked species and may be distinguished from all others by its pale yellow body and sharply contrasting sub-globose or expanded tips. *Clavaria ochraceo-salmonicolor* approaches rather close to this species in the possession of a number of sub-globose swellings at the tips but these do not differ in colour or texture from the rest of the plant.

CLAVARIA SANGUINEA Fr. ex Pers. Pers. Obs. Myc. 2: 61,
pl. 3, fig. 5, 1799.

(Plate XXI., fig. 10, text fig. 1 (H).)

Plants stout and branched, up to 7 cm. high and 3-6 cm. broad. Branches arising from a short, stout stem which is pointed at the base and not deeply rooting. Main branches stout, arising near the ground level and continuing to the base as furrows. Many branches dividing irregularly to form very many small ones which branch once or twice again to form the ultimate tips which are blunt and with one or two blunt cusps. Colour, when young, pallid yellow, later deepening to Maize Yellow, base persistently whitish. Base and all other parts staining a deep reddish brown when handled. Flesh white, soft, only superficially staining red. Taste and odour, very faint. Spores ochraceous, slightly rough, elliptical, 9-11 × 3-4.5 μ with several small guttae and an obliquely terminal mucro. Growing on ground—Kinglake. Not previously recorded for Australia.

This is a distinct and well-marked species but there is some doubt as to its correct name. While otherwise similar to the plant Coker interprets as *C. sanguinea*, our plant has larger spores. Maire and Bresadola, among others, interpret plants which closely resemble ours in spore character, habit, and colour as *C. flava*. However, *C. flava*, as now understood, does not stain red on bruising, and in view of the fact that in all other characters, except size of spores, our plants and Coker's are similar, it seems best to disregard the discrepancy in spore size and call our plant *C. sanguinea*.



Clavaria Spores.

Spores of the following species:—(A) *C. aurantia*; (B) *C. corallino-rosea*, (C) *C. sinapicolor*; (D) *C. acuta*; (E) *C. vermicularis*; (F) *C. rufescens*; (G) *C. pulchra*; (H) *C. sanguinea*; (J) *C. Miyabeana*; (K) *C. australiana* (co-type); (L) *C. fusiformis*; (M) *C. jennica*; (N) *C. capitata* (co-type material); (O) *C. luteostirpata* (type); (P) *C. botrytis*; (Q) *C. pallidiorosea* (type); (R) *C. caepicolorosa* (type). Magnification 1125.

Explanation of Plates.

Unless otherwise stated, all photographs are natural size.

PLATE XVII.

- FIG. 1.—*Clavaria capitata*, young plant showing unexpanded tips.
 FIG. 2.—*C. capitata*, mature plant with expanded tips.
 FIG. 3.—Vertical section of the end of a branch of a mature plant of *C. capitata*. Notice the recurved margins, fusion of adjoining tips, and totally enclosed pockets lined with the hymenium. The white lines represent the hymenium. Magnification 6 X.
 FIGS. 4 and 5.—*C. fusiformis*.
 FIG. 6.—*C. capitata*. Aspect of young plant looked at from above.

PLATE XVIII.

- FIG. 1.—*C. botrytis*, showing clustered habit, and undeveloped basal twiglets.
 FIG. 2.—*C. fennica*. Portion of young plant. Notice knob-like rudiments of the branches.
 FIG. 3.—Large plant of *C. botrytis*, showing elongated branches characteristic of mature and over-mature plants. Two-thirds natural size.

PLATE XIX.

- FIG. 1.—*C. pulchra*.
 FIG. 2.—*C. caepicolorosa*. Mature plants. Notice well-defined stem.
 FIGS. 3 and 4.—Young plants of *C. caepicolorosa*.
 FIG. 5.—*C. luteostirpata*.

PLATE XX.

- FIG. 1.—*C. rufescens*. One-half natural size.
 FIG. 2.—*C. pallidrosea*.
 FIG. 3.—Enlarged view of the tips of young plant of *C. capitata*. Notice the sharp difference in colour of the tips and the branches.

PLATE XXI.

- FIG. 1.—*C. sinapicolor*. Typical large plant.
 FIGS. 2, 3, 4, 5, 6, 7.—Small plants of *C. sinapicolor*, showing varying degrees of fusion.
 FIG. 8.—Medium-sized plant of *C. sinapicolor* apparently derived from a large number of smaller ones.
 FIG. 9.—Medium-sized single plants of *C. sinapicolor*.
 FIG. 10.—*C. sanguinea*.

PLATE XXII.

- FIG. 1.—*C. rufescens*, young plant.
 FIG. 2.—*C. corallino-roseacea*.
 FIG. 3.—*C. aurantia*.
 FIG. 4.—Young plant of *C. botrytis*. Notice the extremely stout base.
 FIGS. 5 and 6.—*C. corallino-roseacea*, showing characteristically twisted plants.

PLATE XXIII.

C. Miyabeana.

